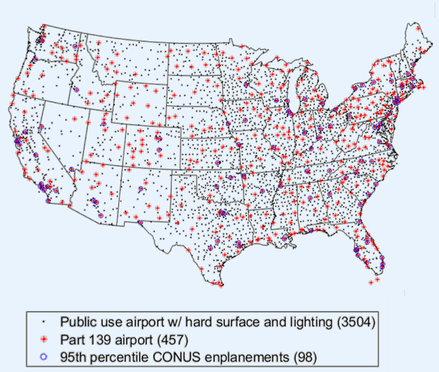
Airports as Energy Nodes

Sustainable Energy Hubs to Benefit AAM Users and Local Communities

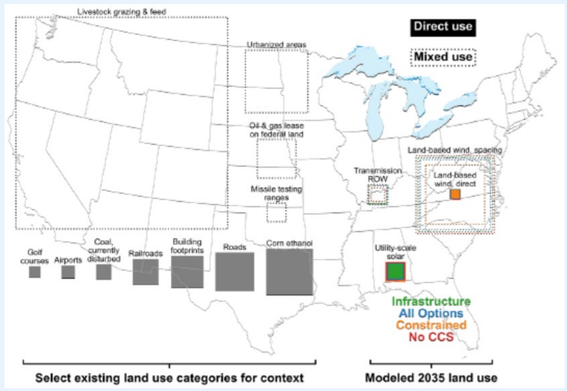
National Aeronautics and Space Administration

Challenge

- How can our existing infrastructure with thousands of public-use airports simultaneously contribute to the growth of Advanced Air Mobility (AAM) and to the broader goal of net-zero emissions in all sectors?
- How can airports handle the energy needs of AAM vehicles in the future?
- How do we provide this energy in a sustainable, reliable fashion at low cost to users?
- How do we leverage airport-hosted energy for non-aviation use in the face of current regulations?



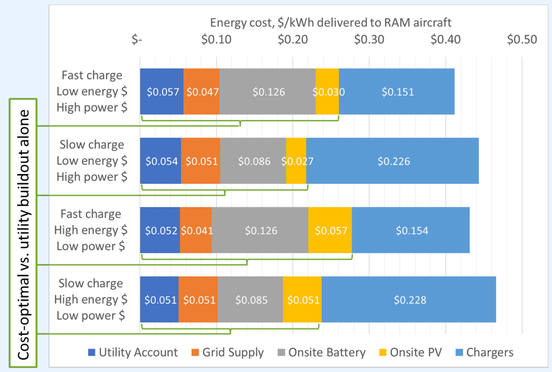
Distribution of public-use airports in the CONUS



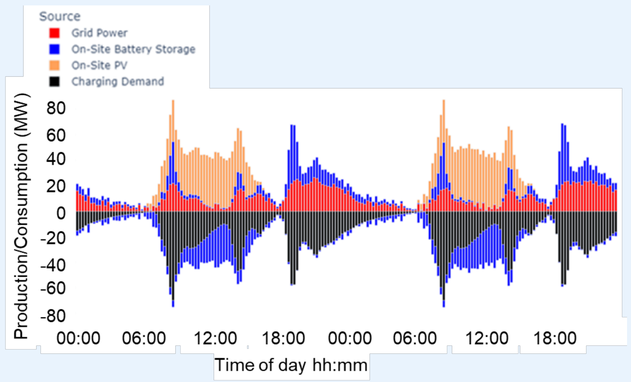
Comparative land use in the CONUS vs. required area for net-zero electricity generation in 2035 (NREL)

Expected Impacts

- AAM vehicles can catalyze renewable energy harvesting, conversion, and distribution at airports
  - Enhance community resiliency to power outages
  - Reduce local emissions and encourage low- and zero-emission aircraft and ground vehicles to recharge/refuel with renewable energy
  - Enhance macrogrid stability through onsite distributed storage
  - Generate "green" fuels from harvested energy and local feedstocks



Amortized cost of electricity for aircraft use



Energy use and mix for battery-electric RAM aircraft for a scenarios in the northeast region (NREL)

Proposed Solution

- Conduct hardware-in-the-loop (HWIL) demonstration of airport microgrid that includes renewable harvesting (solar), onsite storage (battery and H2), onsite conversion (electrolysis), onsite liquefaction (LH2), and distribution to end-use (facilities, equipment, aircraft, and external)
- Demonstrate use through different airport archetypes and operational scenarios, both nominal and off-nominal
- Explore different aviation use cases and policy scenarios, including utility interaction for grid stability

Results

- Developed cost-optimal trades for onsite power harvesting and storage vs. grid upgrades for battery-electric regional air mobility (RAM) scenarios to date
- Consider backup power generation and grid stability, as well as hydrogen life cycle in future iterations
- Leverage NREL platforms for partial HWIL demonstrations

Next Steps

- Work with relevant stakeholders (airports, utilities, regulators, aircraft operators, other end users) to define scenarios that enhance value propositions for all entities
- Identify information to be targeted for regulatory change
- Publish reference architectures for different use cases

Partners and/or Participants

- National Renewable Energy Laboratory (NREL)
- NASA Aeronautics Research Mission Directorate Intercenter Systems Analysis Team (ISAT)
- Georgia Institute of Technology (via ISAT)
- Colorado Department of Transportation
- Newport News/Williamsburg Airport
- Colorado Springs Airport

IMAGINAVIATION

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